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Impacts of Extreme Flood Inundation on Bank Filtration Water Quality

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Bank filtration systems are a significant component of global water supply and considered to be vulnerable to climate change. Understanding the resilience and water quality recovery of these systems following severe flooding is critical for effective water resources planning and management under potential future climate change. We provide the first systematic assessment of the recovery in water quality following extreme inundation at a bank filtration site following an extreme (1 in 17 year, duration $>$ 70 days) flood event. During the inundation event, bank filtrate water quality is dominated by rapid direct recharge and floodwater infiltration (fraction of surface water, fSW $\approx$ 1, high DOC $>$ 140% steady state values (SS), $>$ 1 log increase in micro-organic contaminants, microbial detects and turbidity, low SEC $<$ 90% SS, low nitrate, high DO $>$ 500% SS). A rapid recovery is observed in water quality with most floodwater impacts only observed for 2 - 3 weeks after the flooding event and a return to normal groundwater conditions within 6 weeks (fSW $\approx$ 0.2 – 0.5, higher nitrate and SEC, lower DOC, organic and microbial detects, DO). Recovery rates are constrained by the hydrogeological setting of the site, the abstraction regime and the water quality trends at site boundary conditions. In this case, increased abstraction rates and a high transmissivity aquifer facilitate rapid water quality recoveries, with longer term trends controlled by background river and groundwater qualities. Temporary reductions in abstraction rates appear to slow water quality recoveries. Water resources planners and managers should consider flexible operating regimes such as the one implemented at this study site if riverbank filtration systems are to be resilient to future inundation events under climate change. Development of a conceptual understanding of hydrochemical boundaries and site hydrogeology through monitoring is required to assess the suitability of a prospective bank filtration site against a background of climate change and uncertainty in water resource security.